Achieving transition

BA609 prototype expands flight test envelope as MV22 goes operational.

Photo courtesy Bell

By Alan Staats
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After an 18-month flight test hiatus, the Bell/Agusta tiltrotor team resumed flight testing in Jun 2005. Full conversions to airplane mode have been accomplished and engineers have begun to explore the "hard corners" of the flight test envelope during approximately 60 hours of flight time to date. The second prototype BA609 is expected to fly by the end of 2006.

In 1951 a combined US Army-Air Force program awarded a contract to Bell Helicopters to develop what was referred to at the time as a "convertiplane." Later designated the model 200 and later still the XV3, the aircraft first flew in Aug 1955. (Under)powered by a 450-hp Pratt and Whitney R985 radial engine, the original iteration suffered from severe rotor instability and crashed 2 months after its maiden flight.

By 1958 the XV3 had been reborn with a new 2-bladed semi-rigid rotor system and flight tests began on Dec 12 of that year. A mere 6 days later, the XV3 performed a full 90° conversion in flight.

A combination of high weight and low horsepower resulted in an aircraft that would not hover out of ground effect. Nevertheless, the concept of vertical takeoffs and relatively high-speed horizontal flight did work. During the next 7 years the XV3 made more than 110 full conversions on nearly 250 flights, until the aircraft was destroyed in a wind tunnel mishap in 1965.

In the years that followed Bell and Boeing Vertol continued to explore the possibilities of "convertiplane" technology, with the former concentrating on tilt-rotor designs and the latter focusing on tilt-wing technology. Absent government funding to support the research, though, both companies spent most of their research capital in other, more profitable areas. By the 1970s US Government interest in re-examining tiltrotor technology resulted in a joint Army/Navy/Air Force/NASA contract to design and build 2 examples of what would be known as the XV15. Construction began on the aircraft in Jul 1973, which led to a first flight on May 3, 1979. It would be more than 2 years before the first full conversion was attempted.

Powered by 2 1550-shp Lycoming LTC1K-4K engines, the XV15s flew more than 600 flight test hours and made more than 1800 full conversions. In addition to flight tests to collect raw aerodynamic data, the aircraft were used in sea trials, landing on a number of ships to demonstrate their military capabilities, and took part in civilian demonstrations throughout the country in the middle to late 1980s.

Military representatives were sufficiently impressed with the promise of the technology to form and fund a group to specify the criteria for the HXM—the study designation of a vertical-lift aircraft to satisfy the US Marine Corps' needs for a medium-lift helicopter. Among the criteria the group agreed on were a 300-kt-plus dash speed, ability to take off vertically on a 90° F day with a payload of at least 8190 lb, fuel capacity sufficient for at least 3 hours endurance and a deck "footprint" no larger than that of the Boeing Vertol CH 46 it was intended to replace. The HXM study became the basis for proposing and approving a design-and-bid process for the Joint Service Advanced Vertical Lift Aircraft (JVX) contract, which, starting in 1984, led to development of the Bell MV22 Osprey.

The project's gestation period was not easy—2 of the first 5 prototypes were lost in accidents and a nearly complete redesign was called for. At several points funding for the program was jeopardized as attempts were made to kill the project.

In 2000, as it neared completion of its operational evaluation (OpEval) testing program, 2 fatal incidents occurred within 8 months, mandating a major redesign as well as examination and redefinition of flight parameter limitations.

After the changes were made, new prototypes were built and tested, and during the subsequent OpEval the MV22 met all the requirements and parameters set forth by the US Dept of Defense (DoD) and the Marine Corps. In the summer of 2005 Bell was given the go-ahead for full-rate production of MV22 Block B aircraft

BA609 prototype cockpit uses Rockwell Collins Primus 21 display, nav-com and flight control systems, which will be standard on production aircraft. As the Primus 21 system is scalable, adding features such as EVS/SVS will be relatively simple.

An executive interior is one of at least 3 configurations Bell/Agusta is offering to potential BA609 operators. Also being studied are an 8-seat high-density layout and an EMS configuration. Noise levels measured during test flights are significantly lower than expected.

Photos by Jack Sykes

at its Amarillo TX plant. First delivery of a Block B aircraft took place on Dec 8, 2005. It was assigned to the first operational Marine Corps MV22 squadron, VMM263, which will "stand up" officially on Mar 1, 2006 under the command of Marine LTC Paul Rock, and will likely make its first deployment in 1Q07.

Total procurement figures include 360 MV22s for the Marine Corps and another 48 CV22s for the Navy. USAF Special Operations Command will get 50 CV22 variants equipped with what a Naval Air Systems Command (NavAirSysCom) statement describes as "enhanced capabilities tailored for their unique mission requirements." The Air Force expects the CV22 to reach initial operational capability (IOC) in 2009.

Civil side progress

Bell/Agusta's BA609 effort continues to make progress in several key areas. The 2nd prototype is nearing completion at Agusta's Italian assembly line, and flight-testing on aircraft number 1 was resumed after a 2 year hiatus in Jun 2005.

During a visit to the company's Alliance TX offices, *Pro Pilot* discussed the tiltrotor program with Bell VP Commercial Helicopters & Civil TiltRotor Programs Jack Gallagher.

"Right now," says Gallagher, "we're doing 'envelope expansion'—basically getting all the toughest stuff done first. We'll do all the wild things now and the rest will be easy."

Currently the company has put around 58 hours on the airframe and achieved full conversions to airplane mode.

"The [test] pilots are spoiled," says Gallagher, "because the aircraft is so smooth and vibration-free." The fly-by-wire, triple-redundant control system is capable of processing 88 million instructions per second (MIPS) and has demonstrated the ability to hold position, heading and altitude hands-off in a 35-kt crosswind. Work continues on incorporating the control language into Rockwell Collins Pro Line 21 avionics suite, and the second prototype is expected to join the test flight program by 2Q06.

Orders for the BA609 are reported to be upwards of 80, although company spokesmen will neither confirm nor deny that figure. Fractional share operator NetJets has signed a contract for a "fairly large number" of BA609s, according to Gallagher, but again, actual figures for the deal have yet to be released.

"We see this aircraft going into the foreign and offshore oil markets, corporate operators and fractional operators ... people who are looking to move passengers and/or cargo within a 350 to 500-nm radius, city center to city center. In that operational scenario there isn't any aircraft around that can touch a tiltrotor for time enroute—there's simply nothing faster.

"The main stumbling block is not the technology, though," he continues. "It's a matter of getting the public to accept tiltrotor technology over their heads to the point where city center heliports become a reality. If and when that happens, the BA609 will be an ideal aircraft for the [US] northeast corridor or for just about any city pair in western Europe, for example."

A significant plus in the BA609's favor is that its noise footprint is quite small—current measurements place its noise levels roughly 10 dB below those of a King Air 200.

With DOCs currently estimated at around $1000 an hour, the BA609 is not seen as economically competitive with 6 to 8-place turbine twins until (and unless) the time savings for an executive traveler are leveraged into the equation.

Gallagher remarks, "It's the oldest story in aviation. You have an executive who flies into Teterboro from, say, Chicago, hops into a limo for the drive into downtown New York and spends more time trying to get across the George Washington Bridge than he spent flying in from Chicago.

"With a BA609 that same executive can literally cut an hour or two off that trip, especially at rush hour. So does a tiltrotor make sense, economically? In the long run, there's no question that it does."

Alan Staats is a Phoenix-based writer and photographer who has covered civil and military aviation for nearly 30 years. A former staff instructor at Columbia University Graduate School of Journalism, where he taught photography, Staats operates a studio specializing in fashion and automotive photography.